

# Employment research method for early recognition of skills needs

**Georg Spöttl**

M. A., Director, Institut Technik und Bildung (ITB) der Universität Bremen

**Lars Windelband**

Researcher, Institut Technik und Bildung (ITB) der Universität Bremen

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## SUMMARY

**Given that the early recognition procedures used to date focus on trends and the scenario technique and are less concerned with the design of VET, a research-based employment research early recognition tool was developed as part of the 'EarlyBird' Leonardo Project, by means of which it is possible to identify changes at shop-floor level. What was learnt from use of the instrument may be used to design future-oriented VET. The methods developed were tested in the project, and the changes identified were used to develop well-founded forecasts for the content of future European job profiles in the recycling and machine tool sectors. This article discusses this research tool in more detail.**

## Introduction

What is early recognition? Early recognition is a kind of 'prediction', 'a form of strategic analysis in which a combination of participatory procedures is used for the collection of information of relevance to the future in order to build up scenarios that will facilitate decision-making and concerted action in the present. The participatory essence of the prediction makes it suitable in principle for regional and local planning... (and for the discussion of skills needs, Authors). In some countries there are examples of well-established regional prediction, and in other countries, experiments are being conducted in this direction; however, 'it is totally lacking...at most regional and local levels' (Gavigan/Scapolo, 2001, p. 2).

This definition in terms of regional policy sets out clearly what the essence of early recognition may be, and where its limits may lie. However, the term 'prediction' indicates that despite strategic analysis of participatory procedures and close proximity to the object of the investigation, very precise forecasts of a wide range of developments cannot be expected, although some forward-looking guidance is possible, from which, for example, European policy may learn how social networks ought to be shaped to cope with demographic change. In relation to vocational education and training (VET), this means that an information and decision-making platform can be created that will permit conclusions to be drawn as to future skills needs, using selected research methods for the early recognition of skills needs. Forecasting – or 'early recognition', to use the term employed here – of anticipated developments in industry, craft trades and services thus implies:

Providing appropriate information about the development of skills needs for employment decision-makers and social partners so that decisions can be taken in time about, for example, the reclassifying of occupations and

Creating a 'laboratory' in which it is possible not only to exchange a wide range of research findings but also to profile them so that they are of assistance in decision-making about education policy designed to create sustainable VET and job profiling.

As part of the Leonardo da Vinci project EarlyBird, these challenges were taken up and dealt with using a sectoral research approach. The results contributed to the 'Integrated Guidelines for Growth and Jobs' Nos. 3 and 4 of the European Commission <sup>(1)</sup>(EC 2005).

## Progress to date with early recognition

In the past, quantitative methods were generally developed to estimate future skills needs: from macro-economic projections to surveys of employers and employees (Tessaring 2003; Wilson/Lindley 2005). The macro-economic approaches resulted in long-term forecasts and were used to advise policy-makers. In order to produce more exact statements about the direction of developments, schemes such as the German FreQueNz Network have been developed in recent years, which also reveal qualitative characteristics (Abicht/ Bärwald/ Schuster 2002; Gidion et al., 2000). These have often been combined with quantitative methods, to make it possible to make predictions at sectoral, national and regional level. In Germany, the FreQueNz research network for the early recognition of skills needs has been supported by the Federal Ministry for Education and Research, and is now well established. The aim of the project is to identify skills needs, to develop options for action, and to provide results for a variety of target groups. Many different procedures and methods have been used (work-

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<sup>(1)</sup> Guideline No 3: 'To promote a growth- and employment-orientated efficient allocation of resources' and No 4: 'To secure economic stability for sustainable growth'.

place observation, enterprise case studies, surveys of experts and networks, and statistical analysis) (Schmidt/Dworschak 2004). In the United Kingdom, current skills' bundles are being researched using scenario modelling <sup>(2)</sup>, in order to define skills needs more precisely. This method has already been used in two sectors – financial services and transport (Coles 2003). In Spain, on the other hand, a 'Training Observatory' is now being developed to provide forecasting tools to bundle and evaluate information about skills needs. One of the tools used is the Delphi method of establishing trends and prognoses. An Italian network is collecting information about sectoral scenarios in order to establish job requirements and to make short and medium-term employment forecasts (Gatti, 2003). Other early recognition initiatives of widely varying rigour exist in other European countries, but these cannot all be listed here <sup>(3)</sup>.

From closer analysis <sup>(4)</sup> of the individual procedures and methods, and of their results, it can be seen that the main purpose of most projects is, first, to discover new trends within a field of investigation, and secondly, to develop future scenarios for sectoral, national and regional development. This is done in close alliance with the European policy of supporting growth and employment through action for the future.

As yet, however, little or no use has actually been made of early recognition results for the planning of VET activities in Europe. This may be because the methods employed to date have not revealed detailed changes in sufficient depth. In order not only to show up key lines of development for the enterprises in a given sector, but also to define specific gaps in skills, tools and methods need to be used that shed light on how enterprises work, on what the implications of this are, and ultimately on the whole domain <sup>(5)</sup>.

At this point there is a clear distinction between the purpose of early recognition research and curriculum development schemes, such as that presented by Mulder (1992). Mulder insists on participation by all the groups

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<sup>(2)</sup> In this case a scenario technique is used which is future-oriented but nonetheless seeks to establish very specific bundles of skills which can be transferred to a training programme (Leney, T. et al., 2004). In Germany, the scenario method was first used in the area of VET in the project 'Berufe 2000' (Heidegger/Rauner et al. 1989). Scenarios were designed for future paid work and employment in order to create pictures of a possible or 'desirable' future for VET planning.

<sup>(3)</sup> The European early recognition methods described briefly here, and other procedures, were presented in 2002 at the early recognition conference on the theme of 'Early Identification of Skill Needs in Europe'. Further information and other early recognition approaches can be found on the homepages of the Cedefop network for the early identification of skills needs: [http://www.trainingvillage.gr/etv/projects\\_networks/skillsnet/](http://www.trainingvillage.gr/etv/projects_networks/skillsnet/) and of the German early identification network: FreQueNz: <http://www.frequenz.net/>

<sup>(4)</sup> In the dissertation by Windelband (2006), a number of early recognition methods are examined thoroughly to see whether they are suitable for designing VET.

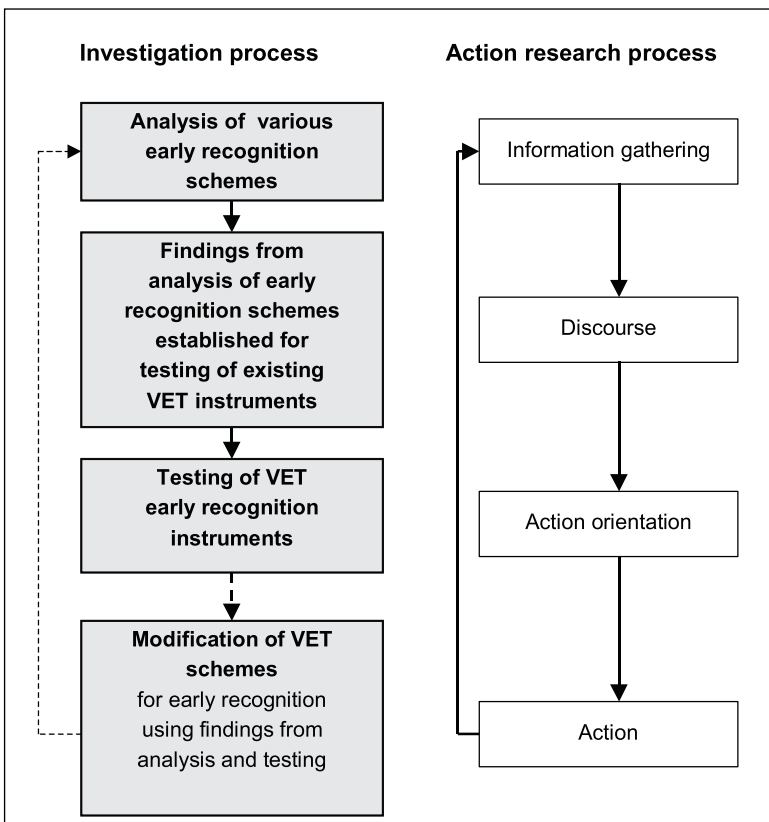
<sup>(5)</sup> A domain is taken to mean an area, a sovereign area or specific area, in which a person is particularly active. Initially it would therefore seem justified to describe any restricted area of action in which someone can function in a 'sovereign' capacity as a domain. This option is used in research into expertise because it is assumed that the skills of an expert can only relate to that person's specific area.

affected (managers, experts, teachers, graduands, etc.) in what he calls curriculum conferences, in order to reach a consensus on curriculum content. Research results about the development of selected fields of work form the basis for the conference. The difference between early recognition schemes and Mulder's ideas lies partly in the intention of the research – early identification of changes in the world of work and their implications – and partly in how the results are presented. There is no monitoring of curriculum development, and the main concern is instead to devise skills and job profiles.

## Focus of early recognition research

In the early recognition project discussed here, an empirical approach was used not only to facilitate more precise examination of developments in the field of work, but also to allow conclusions to be drawn for future skills profiles from the data produced and from the findings on changes in tasks. The focus was on two research questions:

Figure 1: Research designs based on investigation and action research



- What contribution do the early recognition schemes operated to date make to the establishment of job profiles in particular domains?
- How does a research instrument for early recognition need to be designed in order to capture changes in tasks at shop-floor level and to establish the resulting skills needs?
- A twofold research perspective was therefore adopted.

Analysis of various national and European research projects clearly confirmed that little use had been made of the twofold research perspective referred to. This is because most research, regardless of whether it is concerned with social, educational, employment or occupational issues, takes a different direction. The emphasis is almost invariably on diagnostic or comparative research. There is no support for action that is both scientific (e.g. analysis of early recognition schemes) and practical (e.g. analytical findings used to modify VET) with constant cross-checking, such as is required by this research strategy. The starting point chosen for the research was therefore action research since this has the aim of involving action directly in the research alongside analysis and diagnosis.

In the present case, research and design were intended to be closely related by means of a cyclical process in which theory and practical recommendations were continually analysed, tried out in practice and revised and improved as necessary. That is, in order to achieve continual improvement of early recognition methods and interpretation of research results, phases of action and research had to be combined – as in action research.

The aim was thus to use the findings from analysis of existing early recognition schemes <sup>(6)</sup> to improve the employment research strategy that was to be tested. After this had been tested, the instruments used were to be optimised and further developed into a qualitative early recognition tool (see Figure 1). Changes in work and technology were to be at the heart of the investigation, so that conclusions could be drawn for the future-oriented skills profiles required.

The juxtaposition of the research strategy discussed here and the action research method <sup>(7)</sup> in Figure 1 shows that both approaches are based on interactive procedures combining theory with practice. It is only when changes on the 'shop floor' are captured exactly that forecasts can be made of future changes in employment, work processes, technical peculiarities, the structure of company working practices and procedures, working requirements, and the skills and competences arising from these, and of the consequences for job profiles, curriculum development and training <sup>(8)</sup>.

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<sup>(6)</sup> For reasons of space, only the set of early recognition tools developed for VET will be described. The analytical results are discussed fully in Windelband (2006).

<sup>(7)</sup> The term action research can be interpreted in two ways: as *active* research that shapes the environment, and as research which works with a particular pool of *actions* or methods. Action research means a process of sequentially linked actions which typically run in parallel at the theoretical and practical level – albeit in stages – and are provided with continual cross-check loops between the two levels.

Action research discourse played a key role in the discussion and evaluation of the results of the various early recognition methods. Ultimately, the outcome of the debate decided how the early recognition tools used were to be modified and taken forward. This was the point at which the quality of the research tools was crystallised.

## Occupational approach to early recognition research – Justification and research design

The discussion of the various research methods showed that there had only been isolated cases of future-oriented planning of VET. First, the research methods used tended to focus on the current status of the object of the research rather than looking at future developments. Secondly, other research merely produced estimates of trends, without linking these with specific statements about the design of future skills profiles. One of the reasons for this was perhaps that there was an inherent contradiction in the research methods, namely that methods suitable for assessing trends were totally inadequate for the more exact identification of changes in (skilled) work and therefore did not set out to capture the details of the matter under investigation. This was of particular relevance if the intention was not only to predict trends but also to make specific proposals for the content of skills profiles. At that point, at the latest, the second research question became more important since it was concerned with the design of an early recognition method that was capable both of capturing future skills needs and of putting forward suggestions for the content of job profiles. If this was to be made possible, the various types of working conditions on the shop floor needed to be examined thoroughly.

In order to achieve this aim, a research design was required which contained within itself the preconditions for such investigations. Existing methods based on analysis such as EarlyBird, which is part of the Leonardo da Vinci project, had decided to adopt and develop an occupational approach. Ultimately, this had aimed at optimising available empirical tools (see Figure 1) <sup>(8)</sup>. This had been necessary in order not only to capture exactly changes at shop-floor level, but also to forecast how employment, work processes, technical equipment, company working structures and processes, and the associated skills and competences, would change in future, and what consequences this would have for skills profiles, job profiles and training.

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<sup>(8)</sup> A more detailed discussion of social relations would clearly be relevant, but is not considered further here.

<sup>(9)</sup> The employment research tools of sector analysis, case studies and work process analysis were used as the instruments for the investigation.

## Design of early recognition tools for the study of employment

Additional research tools were needed in order:

- to capture details of work on the shop floor, and of its impact,
- to explore technology and technical procedures in depth, to establish the gaps in these and the way in which work is organised, and to look at relevant planning, development and training processes, and the relationships between these,
- to establish the nature and content of actual work processes and tasks,
- to identify the true organisational framework and the steps involved in repair and maintenance work, and
- to establish the 'secret' practical knowledge associated with skilled work.

Only with exact knowledge of the above areas would it be possible to establish the implications of the complex world of work more precisely, to engender a discussion of sectoral job profiles and training based on work processes, and to show the way ahead. Such an outcome clearly went far beyond a general prognosis.

Reference to specific sectors always means looking at the practicalities of vocational training and at the expected levels of competence in an actual field of work that are regarded as necessary and desirable.

In order to achieve this, the project <sup>(10)</sup>

- examined two sectors in detail (recycling and the machine tool industry). A total of 25 case studies were carried out, developments in each sector were analysed, and four expert workshops were held. Four work process studies completed the investigation <sup>(11)</sup>.

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<sup>(10)</sup> No systematised method was used in the project to evaluate the instruments developed and the results. This was because the main purpose was to develop a set of early recognition tools. The results and the project were continually discussed with the project advisory committee, however. The advisory committee of the 'EarlyBird' project consisted of social partners and experts in the two sectors from the five partner countries.

Two-way contacts, and contact between researchers and social partners, were among the research activities involved in the choice of the enterprises to be investigated, and in the investigation itself. The opportunity to exert an influence enhanced the level of involvement of the members of the advisory committee. Particular attention had to be given to this relationship, which ensured that everything learnt was checked. The results obtained from the research steps undertaken were therefore expanded and strengthened in the course of the project.

<sup>(11)</sup> The research strategy – sectoral analysis, case studies and expert discussions – was identical in the individual European countries, so that it was possible to make a European comparison within each sector and to try out the early recognition tools for employment research. The basis for comparing developments within sectors, and especially within enterprises, was the common work processes in the enterprises. It was possible to examine these independently of the different employment systems and to reveal the new requirements that now predominated and could be expected in the sectors in future. For the further development of the instruments, other research methods associated with early recognition were also considered. These included the scenario technique analysed more closely in a project run by Cedefop and the European Training Foundation and used in various sectors in ten European countries (Leney, T. et al., 2004). The results of that project fed into the newly developed set of instruments, in that the scenarios were used as an instrument for the development of future-oriented job profiles. Mike Coles, one of whose roles is to act as coordinator of the Cedefop project, was a member of the advisory committee and thus contributed his expertise.

- developed a set of sector-specific indicators for early analysis of skills needs based on the results of the investigation.

The above-mentioned research instruments made it possible to establish work processes empirically and to identify the knowledge and skills associated with them. The investigation therefore focused on the world of work and the changes within it. The enterprise, together with its organisation, working tasks, technologies, employment structures, innovations and other aspects, was thus the central point of reference for the investigation carried out (Spöttl 2001).

The methods and tools of employment research can be used for a variety of areas of enquiry (Blings/Spöttl/Windelband 2002; Windelband/Spöttl 2004). They consist of:

- sector analysis (level: establishment of sectoral and job structures and of wider employment impact),
- case studies (level: investigation of jobs within enterprises, company

Table 1: Employment research tools for early recognition of skills needs

Level	Instrument	Aim	Methods
Structure of jobs and sector, and wider impact on employment	<b>Sector analysis</b>	Identification of current developments, socio-economic institutions, trends and changes in tasks within a sector; Future development of technology and organisation of work.	Document analysis (surveys of research institutes, associations, trade unions); Surveys of key persons; Analysis of continuing VET provision; Analysis of research activities and results in the sector (universities, independent research institutes, company research institutes).
Jobs within enterprises, work processes, ways in which work and enterprises are organised, enterprise structures, overall operation	<b>Case studies</b>	Details of shop-floor work and of factors and changes influencing it; Development of enterprises and of ways in which they are organised.	Observation of work; semi-structured specialist interviews; discussion with experts at all levels; visits to enterprises.
Competences in future-oriented company and work processes.	<b>Studies of work processes</b>	Identification of work tasks and nature of work within enterprises, and of 'secret' practical knowledge of skilled work; Design of work, technology, knowledge and organisation of work and enterprise.	Observation of work; Analysis of work tasks; action-oriented targeted interviews; discussions with experts; discussion with skilled workers.
Significance of trends identified for an area of employment. Anticipated future developments.	<b>Expert workshops on the future</b>	Identification and structuring of highly relevant tasks for skilled workers; Trends and forecasts of further skills developments in selected fields of employment.	Brainstorming; targeted discussions on development of scenarios with selected experts and others from the sector and from associations and trade unions.



practices, types of work and enterprise organisation, structures of enterprises, overall operations),

- work process analysis (level: establishment of competences in company and work processes) and
- expert workshops on the future (level: significance of trends identified for a given sector).

The aim of the investigation was to establish the knowledge, skills and competences needed to perform a job in association with actual company and work processes rather than in the abstract. This kind of skills research gives priority to participatory analysis of skilled work and assumes a basic knowledge of the matter under investigation. Employment skills research is therefore domain-specific, that is, it deals with particular areas of work (Becker 2003).

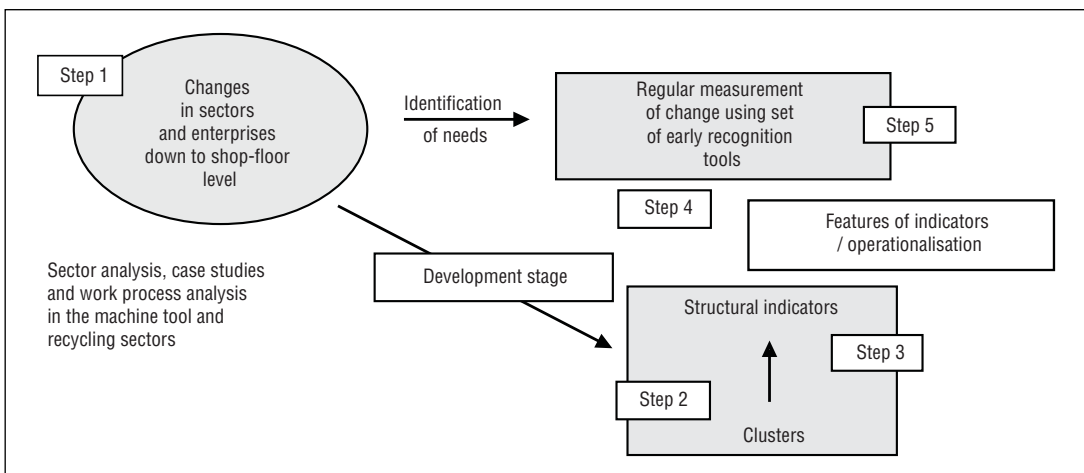
### Usefulness of the individual instruments

*Sector analysis* was of particular importance since this instrument is intended above all to capture new developments and trends in the sector. The main subject of the investigation was thus changes in employment within a sector over a given period (see Table 1), looking at trends in development, the relevance of individual fields of business, innovations in technology and the organisation of work, and other pertinent factors. In order to shed light on future developments and trends, sector analysis was expanded in two directions for the purposes of early recognition:

- examination of innovative fields of research, and
- analysis of innovative continuing VET relevant to the sector.

The results of the sector analysis were explored further in selected case

Figure 2: From changes in sectors to new skills training



*studies* <sup>(12)</sup> to see how the world of work had changed (see Table 1). The selection criteria for the case studies included:

- belonging to the sector,
- relevance of the location of the economic region,
- innovative nature of the enterprise (changes and pressures to change in the organisation of the enterprise and of the work, innovative practices and products),
- development dynamics (growth in economic power: market share, turnover),
- enterprises changing or subject to a process of change, and
- range of activities (split between services, products, type of production, assembly work, external relations).

Forward-looking enterprises needed to be identified for the case studies. In the recycling sector, the enterprises selected were active in several areas and had been able to shift their emphasis in response to market conditions. The reason for this was the varying market prices of second-

Table 2: **Extract from the structural indicators and their operationalisation for the machine tool sector**

Cluster	Structural indicators	Operationalisation for engineering / machine tool sector
<b>Organisation of work</b>	Organisational structures	<ul style="list-style-type: none"> <li>• Changes in organisational structures (e.g. 'lean production', project work),</li> <li>• Spread of flatter structures,</li> <li>• Spread of new models of work organisation (group and team work).</li> </ul>
	Responsibility structures	<ul style="list-style-type: none"> <li>• Shifts in structure of responsibility,</li> <li>• Changes in areas of responsibility,</li> <li>• Growth or decline in responsibility at shop-floor level.</li> </ul>
<b>Technology</b>	Spread of ICT	<ul style="list-style-type: none"> <li>• Increase in widespread use of ICT such as SPS / CNC / CAD / CAM in production / processing / quality control measurement,</li> <li>• Implementation in new fields.</li> </ul>
	Production techniques	<ul style="list-style-type: none"> <li>• Spread of laser processing equipment, near net shaping, robot technology, cutting techniques (e.g. water jet cutting, laser cutting), linear direct drives, measurement techniques (e.g. laser measurement), parallel kinematics and other new production techniques.</li> </ul>
	Products	<ul style="list-style-type: none"> <li>• New innovative products (with full service),</li> <li>• Changes in prices of machinery,</li> <li>• Use of new materials (plastics, ceramics),</li> <li>• New ways of providing service such as teleservice, counselling, training courses.</li> </ul>

<sup>(12)</sup> How a case study was defined exactly depended on the specific research task or intention. Each case study therefore needed both to be typical of a sector, and to demonstrate its unique character.

ary raw materials. In the machine tool sector, forward-looking enterprises were distinguished by having an 'open' enterprise structure. These demonstrated a high degree of dynamic development.

Each case study referred to one or more similarly situated enterprises together with the associated environment of initial and continuing training institutions. The aim was to analyse precisely the work tasks carried out in the enterprise(s).

Where the results of sector analysis and the case studies showed that work tasks at the shop-floor level had changed hugely because of new influences, new machinery, new ways of working, new legislation, etc., and that this was of great importance for the sector, further in-depth analysis was necessary in order to capture the exact impact on work processes. The instrument of *work process analysis* was then used. Work process analysis was regarded as an extension of the case studies <sup>(13)</sup>, and was used to capture the knowledge and skills used to carry out work tasks, working conditions and operations, and the challenges to be resolved. Selected work processes in both sectors were established with the help of work process analysis, such as the process for managing accelerated rotting equipment and, in the machine tool sector, the rapid prototyping process <sup>(14)</sup>.

In order to give greater solidity to the empirical findings, indicators were developed heuristically to show exactly what was changing where within each sector. These were termed structural indicators and are to some extent transferable to other sectors <sup>(15)</sup>. Figure 2 summarises schematically how the indicators were developed and operationalised on the basis of the investigation. It shows the sequence of steps clearly. As a first step, all the changes identified in the sectors, right down to the shop-floor level, were captured and listed. In the second step, all the changes found in Step 1 were structured and clustered. Because cluster structures did not exist for this purpose, they were created on the basis of plausibility. One important criterion was that minor and major changes in work tasks had to be recognisable. This was also expressed in the structural indicators, which concentrated on parameters characterising major structural change (Haas 2002).

In Step 3, indicators were derived and arranged, on the basis of the changes collated. These indicators were then operationalised in Step 4. Future changes in work tasks in the sectors were subsequently measured using the framework of indicators developed (Step 5).

<sup>(13)</sup> A case study involved around 1-1.5 days in an enterprise. Work process analysis usually requires 4-5 days to capture selected work processes completely.

<sup>(14)</sup> In total, four work process analyses were carried out as part of the project, to capture exactly the content mentioned above and to test the instrument. Case studies and sector analyses were carried out in all five European countries.

<sup>(15)</sup> A literature and Internet search by the authors showed that there was as yet no suitable design of indicators to identify employment skills needs. The indicators referred to in social science literature pursue other objectives.

Before being used, the indicators were operationalised and evaluated to ensure that they would make changes visible. Operationalisation meant specifying what had changed in enterprises, equipment, services, etc., and might lead to new skills profiles for skilled workers.

Overall, 31 indicators and 10 clusters were devised for the machine tool sector <sup>(16)</sup> (see Table 2).

Since indicators were developed in two sectors, much of interest was learnt in relation to transferability. Because the aim of the project was to identify and develop indicators on the basis of real empirical surveys <sup>(17)</sup>, the indicators could not be too detailed. However, in order to describe change, it was advantageous to formulate the indicators at a level of abstraction which was not too general, and yet captured the context without being too differentiated. If they were too detailed, they could not be used to capture development trends. The essential point was that the indicators had to be operationalisable. If that was the case, then it would be possible to identify changes with sufficient accuracy. Ultimately, the indicators operationalised did not relate exclusively to one sector and can be transferred to other sectors.

All the same, it should be remembered that the same sector-specific context is not hidden behind every actual indicator. The context actually described at the operationalisation level of an indicator may differ from sector to sector. The advantage of the potential transferability that nonetheless exists is to be seen in the ability of the same indicators to represent changes in different sectors. This considerably increases the transparency of the developments explained. In our case, the indicators were developed for the purpose of investigating the machine tool sector, and were then transferred to the recycling sector. By means of the iterative operationalisation process usual in such cases, it was possible to construct a skeleton of indicators suitable for both sectors. This will doubtless undergo further change and development in the future. However, it has been demonstrated that the indicators developed are suitable for both sectors, even though the sectors are differently structured.

However, it may well be that a core of indicators will be valid for all or a number of sectors after further differentiation, while there will probably be some indicators that will constantly change. One essential advantage of the indicators identified here for specific sectors is that developments that are highly relevant to early recognition schemes can be described relatively exactly by them.

The results of the investigations show very clearly that it was possible to depict real work processes in enterprises, and the structures and devel-

<sup>(16)</sup> The process of developing the indicators is described in Windelband/Spöttl (2003b).

<sup>(17)</sup> Broad indicators such as international trends or macro-economic developments were not developed specially since other research institutes such as IAB (Institut für Arbeitsmarkt- und Berufsforschung in Germany) had been working specifically on these issues for years. Where these developments were significant for the sector under investigation, the results were fed into the analysis.

opment of enterprises by means of the research instruments used, although forecasts of further developments more than 5 years ahead could not be made, or were at best sketchy. For this reason, expert workshops on the future were further developed as an instrument by the project team.

At the expert workshops on the future <sup>(18)</sup>, the results identified by means of the employment research strategy were collated to form scenarios for future European job profiles, with the help of sectoral experts (representatives of bvse <sup>(19)</sup> and VDMA <sup>(20)</sup>, and from enterprises) and of key persons (the project advisory committee, vocational training experts from BIBB and European experts) <sup>(21)</sup>. The key persons selected were distinguished by their knowledge of such fields as:

- new developments and trends in the sector,
- changes occurring in enterprises,
- changes to working tasks in the sector,
- new skills strategies in the sector,
- VET strategies in Europe.

The advantages of these workshops was that key individuals and decision-makers from associations, enterprises and VET could 'sit around a table' and debate scenarios for skills profiles, job profiles and other competence models.

## Project results

The use of the research design in individual partner countries made it possible to capture changes at shop-floor level in the two sectors investigated and to interpret these for the future <sup>(22)</sup>.

In recent years, the profile of requirements in the recycling sector has changed considerably in the individual countries, both as a whole and at various levels. The main cause is the increased regulation of the handling of secondary raw materials. In the Netherlands, Austria and Germany, employees in the sector face new service demands such as taking delivery of used materials (waste) from suppliers, checking these for alien substances, and managing the paperwork associated with waste (waste disposal certificates and consignment notes). The work is now organ-

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<sup>(18)</sup> Four expert workshops on the future were held together with project partners, experts and the project advisory committee.

<sup>(19)</sup> bvse- Bundesverband Sekundärrohstoffe und Entsorgung e.V. (Federal Association for Secondary Raw Materials and Waste Disposal)

<sup>(20)</sup> VDMA - Verein Deutscher Maschinen- und Anlagenbau e.V. (Association of German Machine-Making Companies)

<sup>(21)</sup> Policy-makers did not initially take part in the expert workshops on the future, but this target group was integrated into the sector analysis survey. If re-used in future, the whole instrument should be accompanied by a process evaluation to provide constant feedback on the results in the sector at policy level as well.

<sup>(22)</sup> The research strategy and methods concentrated on changes in the world of work. Where conditions were appropriate, it was possible to transfer the results to skills training in VET systems.

ised so that skilled workers can advise clients on what papers are needed and on the requisite sorting and packing of the goods delivered. Clients are given information about ways of avoiding, re-using and disposing of waste. Enterprises offer their clients a service that accords with the client's wishes.

The trend towards increasingly automated systems, sometimes with widespread use of ICT, can also be seen in this sector and in changes in the range of tasks expected of employees working in recycling. The ability to remove alien substances and carry out repairs is playing an ever greater role. This presupposes basic technical skills and considerable experience with equipment, in order to judge its 'behaviour' when alien substances are present, and to correct faults appropriately. It is increasingly important for workers to understand the main functions of the equipment, but the ability to analyse and remove the causes of disruption is yet more crucial. Operators need to know about the process and how it functions in order to correct, or preferably to prevent, break-downs.

These developments, and the changes in tasks associated with them, demonstrate the need for skills training in the sector. This may take the form of job profiling, although other types of skills development may also be called for.

New challenges were also identified in the second sector investigated, the machine tool industry. The substantial changes at the work place are leading to new, decentralised arrangements at lower levels of the job hierarchy. As a result, skilled workers face a variety of challenges:

- Behaviour needs to be developed or already present to support company operations.
- Maximum priority needs to be given to performance of tasks.
- Management competence is needed to ensure that processes are carried out and that the tasks allocated can be performed independently.
- Besides technical execution of tasks, there is also a need for cooperative, organisational and planning ability, etc.
- Continual quality enhancement needs to be achieved by means of proven quality awareness and the ability to think for oneself.
- The design of production processes should help to drive innovation in processes and products.

It is obvious that there is a need to modify existing skills profiles since vocational trainers frequently still cling to traditional technologies and non-existent working tasks.

This rudimentary extract of the results shows that thought needs to be given to changing and redesigning skills profiles in both sectors in Europe. The expert workshops on the future, involving project partners, sectoral experts and key persons from various European countries, therefore set out to design scenarios for further European skills and job profiles <sup>(23)</sup>. It

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<sup>(23)</sup> The scenarios identified should not be regarded as forecasts based on quantitative information from the past and present, or as utopian fantasies that have no basis in reality. They are based on the results of sectoral investigation.

was not assumed that it would be possible to apply these one for one, but that they should:

- help prepare for future sector-specific developments,
- provide key ideas for future-oriented job profiles, and
- show up a broad, future-oriented range of developments in order to assist social partners in the 'design' of modern job profiles.

Overall, seven job scenarios were designed for European use; five job profiles for the machine tool sector and two for the recycling sector <sup>(24)</sup>.

## Summary

The employment research method developed for early recognition of skills needs was based essentially on indicators by means of which changes in a sector could be constantly observed at shop-floor level. The indicators were derived from what was learnt from the studies conducted. They may be regarded as the crystallisation of early recognition.

The newly developed early recognition system for identifying skills needs, based on indicators, is sector-based and has two aims:

- to obtain information for the design of VET and skills and job profiles, and
  - to help forecast skills needs in a variety of occupational fields.
- In order to obtain information for the design of VET and job profiles, the authors recommend the tools of sector analysis (analysis of sector and employment structures, and of current and likely future developments in the sector), case studies (investigation of work places and company and work processes) and work process analysis (identification of knowledge and skills implicit in future-oriented working tasks). The employment research tool of sector analysis was expanded to improve forecasting of future developments by the addition of consideration of research fields in the sector, analysis of innovative VET provision and analysis of sector-specific measurements and activities.

The expert workshops on the future, newly developed within the project, were used to identify sectoral trends and scenarios for future European job profiles. The scenarios revealed that VET and VET policy cannot rely on reaction alone in industry and craft trades. The employment research method described here, in association with the development of scenarios, opens up ways of achieving early recognition of the changes to be expected in Europe, and of reacting to these through proposals for European job profiles. Essentially there are two possibilities:

- the involvement of VET experts in design in this field.
- cooperation in the production of future-oriented VET and skills and job profiles in Europe.

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<sup>(24)</sup> All seven occupational scenarios have been described more fully by Spöttl/Windelband (2003).

These could help to overcome the 'pragmatism' that predominates in many sectors and countries by fostering streamlined, effective European planning.

Above all, the indicators already available, in conjunction with the research method, can help to identify anticipated developments at 'shop-floor' level in a given sector more quickly and more exactly. Changes in enterprises, down to the level of work processes, can be captured relatively precisely by means of this set of instruments, and it can be decided more rapidly whether particular developments only apply to certain enterprises or areas of work, or are meaningful for the entire sector throughout Europe.

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